INVESTIGATIONS OF THE MARINE ALGAE OF SOUTH CAROLINA
I. NEW RECORDS OF RHODOPHYTA

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The most extensive accounts of benthic marine algae occurring in South Carolina were included in larger surveys of marine algae from North America by William H. Harvey (1852, 1853, 1858), and from Beaufort, North Carolina and adjacent regions by W. D. Hoyt (1920). Their findings were based on brief visits to this state. Considering the dearth of information on the marine algae of the South Carolina coast, a preliminary survey of one of the major groups, the Rhodophyta, has been initiated. This paper newly records 31 taxa of red algae from this region.

MATERIALS AND METHODS

The intertidal collections (Fig. 1, Collection Stations 1-8) were made and identified by the first coauthor over the past several years. The pelagic collections (Fig. 1, Collection Stations 9-18) were obtained by dredging by Dr. R. B. Searles of Duke University from the R/V *Eastward*, Cruise E-7-74, June 11-12, 1974. The second coauthor participated in this cruise and identified the specimens. Representative specimens have been deposited in the Duke University Algal Herbarium.

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Offshore

Eastward Cruise E-7-74

#9 Eastward Station 24518
33°12.6'N 78°25.0'W
Depth 24M 11 June 74

#10 24531
32°35.5'N 78°45.5'W
Depth 38M 12 June 74

#11 24532
32°35.3'N 78°49.5'W
Depth 38M 12 June 74

#12 24533
32°33.0'N 78°36.5'W
Depth 50M 12 June 74

#13 24534
32°33.1'N 78°37.0'W
Depth 54M 12 June 74

#14 24535
32°35.9'N 78°37.2'W
Depth 40M 12 June 74

#15 24536
32°43.0'N 78°34.0'W
Depth 25M 12 June 74

#16 24537
32°44.0'N 78°30.5'W
Depth 45M 12 June 74

#17 24539
32°51.5'N 78°17.0'W
Depth 40M 12 June 74

#18 24542
33°03.9'N 77°56.5'W
Depth 40M 12 June 74

Onshore

#1 Windy Hill

#2 Myrtle Beach

#3 North Island, Winyah Bay

#4 Sullivans Island

#5 Fort Sumter, Charleston Harbor

#6 Fort Johnson, Charleston Harbor

#7 Bears Bluff, Wadmalaw Island

#8 Chechesse River, Port Royal Sound

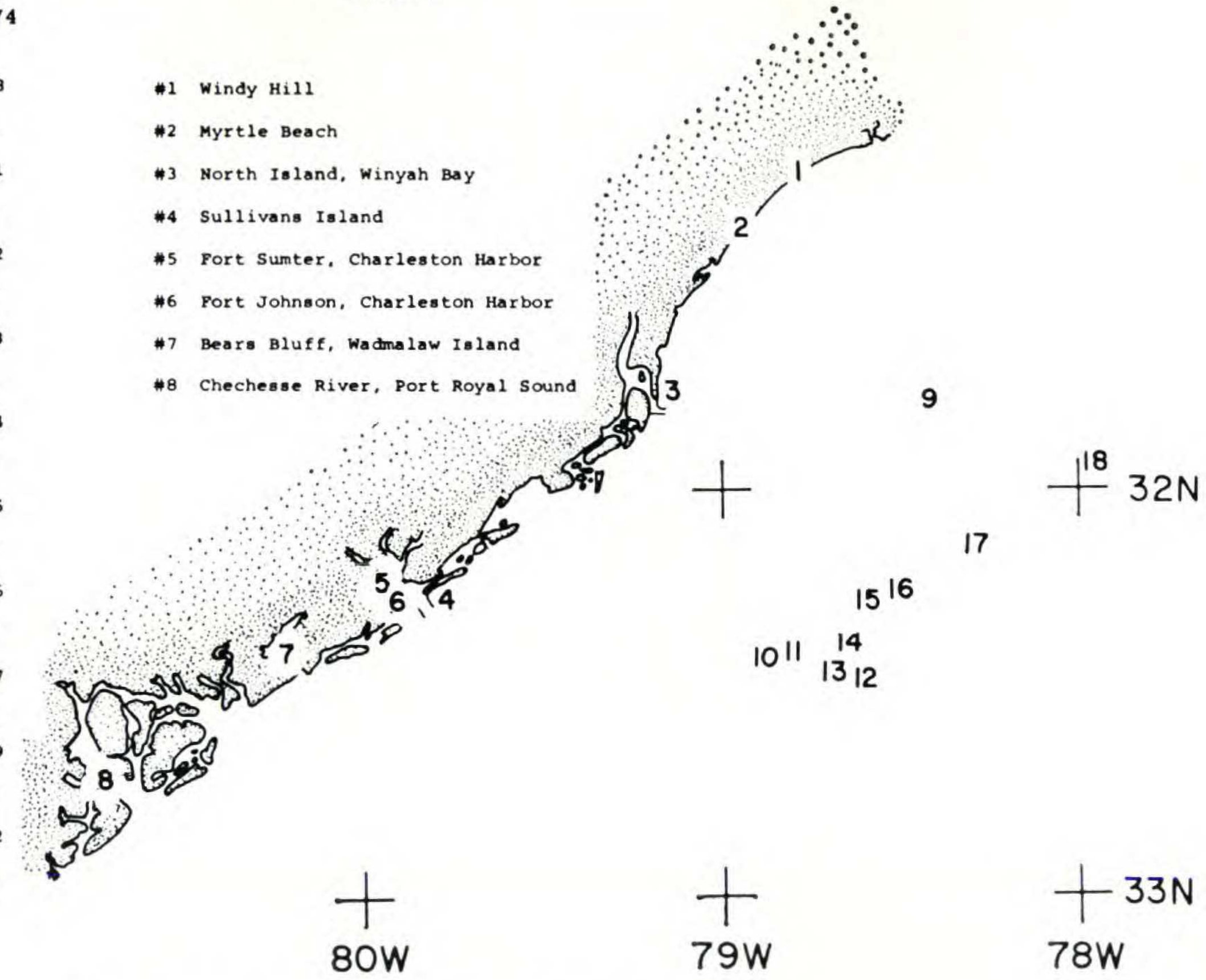

Figure 1. South Carolina collection stations.

HISTORICAL SUMMARY

Jacob W. Bailey (1848) published the first records of marine algae from South Carolina based on specimens sent to him by Professor Lewis R. Gibbes of Charleston. Bailey was assisted in the determinations by William H. Harvey of Trinity College, Dublin. This paper and one published the previous year by Bailey were the first phycological papers published in the United States (Zaneveld, 1966). Seven species were listed from South Carolina, but *Ectocarpus viridis* Harvey (= *E. siliculosus* (Dillwyn) Lyngbye) was inadvertently placed by Bailey in both the "Chlorospermeae" and the "Melanospermeae", thus reducing the species recorded from the state to 6 with three of the six in the "Rhodospermeae". Bailey later (1851), in an extensive report on desmids and diatoms from the southeastern United States, included 4 species of macroscopic marine algae. Three of the 4 species were red algae with 2 of these new rhodophycean records for South Carolina.

William H. Harvey stopped briefly at Charleston in January and March, 1850, in transit to and from Key West, Florida. Aided by L. R. Gibbes and H. W. Ravenal, he collected 29 species of marine algae from the Charleston area. Harvey included these findings in his monumental *Nereis Boreali-Americana* (1852-1858). Thirteen of the 17 red algae reported by Harvey (1853) were new records for the state. Harvey cited all of the species previously reported by Bailey with the exception of *Rhodymenia palmata* (L.) Greville, which was listed by Bailey in the 1848 paper. The latter species has not been recollected from South Carolina, and more than likely the plants identified as *R. palmata* are really *R. pseudopalmata* (Lamouroux) Silva, a species commonly found on the harbor jetties at Charleston.

Jordan (1874) and Farlow (1876) listed species of marine algae from South Carolina in distributional notes, but all of these records were taken from Harvey's *Nereis Boreali-Americana*.

Melvill spent the winter of 1871 and the spring and summer of the following year at Charleston. He reported (1875) 22 taxa of marine algae from this region, all but two of which had previously been cited by Bailey and Harvey. The two new additions, the pelagic brown alga, *Sargassum bacciferum* (Turner) C. Agardh (= *S. fluitans* Børgesen or *S. natans* (L.) Meyen), and a red alga, *Callithamnion baileyi* Harvey, were cited by Harvey in *Nereis Boreali-Americana* but were not reported from South Carolina.

Hoyt visited Georgetown, Pawleys Island, Charleston, and Port Royal Sound in South Carolina during the summer months of 1909. He commented (1920) on 21 species and a variety of marine algae from the state. The variety and 15 species were red algae, six of which represented new records for the state.

In April 1947, Stephenson and Stephenson (1952) studied intertidal zonation on the jetties, breakwaters, and seawalls in Charleston Harbor, the area around Bears Bluff Laboratory on Wadmalaw Island, and a narrow channel (Eliot Cut) connecting the Stono and Ashley Rivers. They reported 14 genera of algae with two of the genera not determined to species. Seven of the 12 genera determined to species were red algae. Three of the 7 reds were new records for the state, while the other 4 species probably represent taxa previously reported under different specific epithets.

During the years 1947 to 1949, Pearse and Williams (1951) investigated the biota of the submerged "black rock" formations off the coasts of North and South Carolina. On August 16-17, 1949, they made collections at a formation near Little River, South Carolina. Williams compiled the section of algal vegetation and listed 104 taxa from both states with 67 of these placed in the Rhodophyta. With the exception of the 'Carolinas only' notation under which he listed 11 taxa, the format used in the distributional synopsis has made it impossible to ascertain with certainty records for South Carolina. Five of the 11 taxa

cited under 'Carolinas only' represent new rhodophycean records for the state.

W. R. Taylor (1957, 1960) cited 41 species and 3 varieties of marine algae from South Carolina with 30 of these in the Rhodophyta. Most of the taxa listed by Taylor were previously reported by either Bailey, Harvey, Melvill or Hoyt.

Schneider (1975) reported two new and interesting additions to the South Carolina marine algal flora, *Acrosorium uncinatum* (Turner) Kylin and *Rhododictyon bermudensis* Taylor. The former species was collected by dredging at Collection Stations #13, 14, 16, 17 (Fig. 1), and the latter species at Station #13. Schneider and Searles (1976) have also collected five additional new taxa by dredging in the same region, including: *Hypnea volubilis* Searles, *Petroglossum undulatum* Schneider, *Sarcodiotheca divaricata* Taylor, *Rhodymenia divaricata* Dawson, and *Lithothamnium occidentale* (Foslie) Foslie. These 7 new offshore records, as well as the ones reported in this paper, attest to the richness and diversity of the deep water flora of this coast, and future exploration should yield many new additions.

Taxa of red algae previously reported from South Carolina are listed below. Some of these have been regarded as uncertain records for the state and are in need of reconfirmation.

Bangiales

Porphyra leucosticta Thuret in Jolis
Porphyra umbilicalis (L.) J. Agardh

Gelidiales

Gelidium corneum (Hudson) Lamouroux
Gelidium crinale (Turner) J. Agardh

Cryptonemiales

Grateloupia filicina (Wulfen) C. Agardh
Grateloupia gibbesii Harvey

Gigartinales

Gracilaria foliifera (Forsskål) Børgesen
Gracilaria foliifera var. *angustissima* (C. Agardh) Taylor
Gracilaria sjoestedtii Kylin
Gracilaria verrucosa (Hudson) Papenfuss
Eucheuma gelidium J. Agardh
Neoagardhiella baileyi (Harvey *ex* Kützing) Wynne & Taylor
Soliera tenera (J. Agardh) Wynne & Taylor
Hypnea musciformis (Wulfen) Lamouroux

Rhodymeniales

Rhodymenia pseudopalmata (Lamoroux) Silva
Rhodymenia pseudopalmata var. *caroliniana* Taylor
Lomentaria baileyana (Harvey) Farlow

Ceramiales

Callithamnion byssoideum Arnott *ex* Harvey in Hooker
Callithamnion polyspermum C. Agardh
Ceramium rubrum (Hudson) J. Agardh
Ceramium strictum (Kützing) Harvey
Pleonosporium borreri (J. E. Smith) Nägeli *ex* Harvey
Caloglossa leprieurii (Montagne) J. Agardh
Grinnellia americana (C. Agardh) Harvey
Calonitophyllum medium (Hoyt) Aregood
Hypoglossum tenuifolium (Harvey) J. Agardh
Dasya baillouviana (Gmelin) Montagne
Bostrychia radicans (Montagne) Montagne
Bostrychia radicans form *moniliforme* Post
Chondria atropurpurea Harvey
Herposiphonia tenella (C. Agardh) Schmitz form *secunda* (C. Agardh) Hollenberg
Polysiphonia denudata (Dillwyn) Kützing
Polysiphonia harveyi Baileyi
Polysiphonia nigrescens (Hudson) Greville
Spyridia filamentosa (Wulfen) Harvey

RESULTS

List of new records of red algae from South Carolina with Collection Stations.

Bangiales

Bangia atropurpurea (Roth) C. Agardh 4, 5

Gelidiales

Gelidium pusillum (Stackhouse) Le Jolis 6, 7

Cryptonemiales

Corallina officinalis L. 2

Halymenia hancocki Taylor 10, 11, 17, 18

Heteroderma lejolisii (Rosanoff) Foslie 2

Peyssonnelia rubra (Greville) J. Agardh 12, 13, 14, 16, 17

Gigartinales

Gymnogongrus griffithsiae (Turner) Martius 2, 3

Gracilaria mammillaris (Montagne) Howe 9, 12, 13, 14, 16, 17, 18

Plocamium brasiliense (Greville) Howe & Taylor 12, 14, 16, 17

Predaea masonii (Setch. & Gard.) DeToni 14

Rhodymeniales

Agardhinula browneae (J. Agardh) DeToni 9

Gloioderma atlantica Searles 13, 14, 17

Botryocladia occidentalis (Børgesen) Kylin 14, 16, 17

Botryocladia pyriformis (Børgesen) Kylin 17

Ceramiales

Antithamnion cruciatum (C. Agardh) Nägeli 3

Antithamnion cruciatum var. *radicans* (J. Agardh) Collins & Hervey 12, 13, 14, 17

Apoglossum ruscifolium (Turner) J. Agardh 17

Branchioglossum prostratum Schneider 13, 14, 16, 17

Ceramium byssoideum Harvey 3

Ceramium diaphanum (Lightfoot) Roth 1

Chondria tenuissima (Goode. & Woodw.) C. Agardh 8

Compsothamnion thuyoides (Smith) Schmitz 12, 13, 16, 17

Griffithsia tenuis C. Agardh 14, 16, 17, 18

Heterosiphonia wurdemanni (Bailey *ex* Harvey) Falkenberg var. *laxa* Børgesen 12, 17

Membranoptera subtropica Schneider	12, 13, 14, 16
Nitophyllum wilkinsoniae Collins & Harvey	12, 13
Polysiphonia tepida Hollenberg	3
Polysiphonia sphaerocarpa Børgesen	3
Pterosiphonia pennata (Roth) Falkenberg	3
Spermothamnion investiens (Crouan) Vickers var. *cidaricola* Børgesen	13, 17
Spyridia hypnoides (Bory) Papenfuss	2

DISCUSSION

The above list of 31 new records of red algae from South Carolina nearly doubles the list of rhodophycean taxa known from this region. About 200 taxa of red algae have been reported from North Carolina, South Carolina, and Georgia with most of these records from North Carolina. The above list of 35 taxa of reds previously reported, and the present list of 31 new records for South Carolina, a total of 66, belies what really is the red algal flora of the state. More intensive collecting should markedly expand the list.

The delesseriaceous species *Apoglossum ruscifolium* known only from Europe, the Falkland Islands, and the Atlantic coast of Argentina is newly reported from the western North Atlantic. *Spermothamnion investiens* var. *cidaricola,* described by Børgesen from the West Indies, is reported for the first time from the Carolinas. The following taxa have previously been reported only from North Carolina: *Gloioderma atlantica, Branchioglossum prostratum, Membranoptera subtropica.*

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